



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :  B41J 3/36	A1	(11) International Publication Number: WO 91/05665  (43) International Publication Date: 2 May 1991 (02.05.91)
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(22) International Filing Date: 25 June 1990 (25.06.90)		
(30) Priority data: 8923692.1 20 October 1989 (20.10.89) GB		(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE*, DE (European patent)*, DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.
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(72) Inventors; and		Published
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(54) Title: IMPROVEMENTS RELATING TO HAND-HELD PRINTERS		
(57) Abstract		
<p>A printing unit comprises a main housing (1) with an upwardly extending handle (2) in which are mounted the control circuit panels (4, 5) for controlling an ink jet printer (3) in accordance with signals fed through a supply cable (6) from a computerised keyboard unit. As the housing (1) is drawn across a sheet of paper, a toothed belt (8) drives wheels (9 and 10), thus causing rotation of a disc (11). This disc incorporates slots and passage of the slots past a lamp (13) is sensed by a collector (14) aligned with the lamp (13), and signals indicative of the extent of movement of the printer over the sheet are sent to the control circuit (4). This control circuit determines the operation of the ink jet printer (3) at suitable instances to create a line of predetermined characters onto the sheet.</p>		

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"Improvements relating to Hand-Held Printers"

There is a need for a portable printer which can be held in the hand and which can be used for quick printing of small amounts of information on documents, etc. This would be particularly useful, for example,  
5 for the printing of receipts such as by salesmen or debt collectors, or the printing of "sell-by" dates on consumer goods.

According to the invention, there is provided a hand-held printer having a generally flat base portion,  
10 a printing unit housed within the printer so as to be able to print through an aperture in the base portion, a command unit within the printer housing for instructing a sequence of characters to be printed by the printing unit, and a position transducer located within the  
15 printer housing for determining the extent of movement of the base portion across a surface with respect to a starting point and connected to the command unit to determine the instants of printing of characters as a function of said extent of movement.

20 Such a hand-held printer can be applied directly to a sheet or a document or a booklet on which information is to be printed and, subject to the issuance of a print command at a suitable time, as the printer is moved

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across the surface of the sheet, the relevant information will be printed. The speed of movement of the printer over the sheet will not be critical because the position transducer will only allow printing of a character when the printer has been moved by a required amount across the sheet.

Ideally the position transducer comprises a movable member projecting from the base portion to contact a surface to be printed and be moved with respect to the printer housing as the base portion is moved across the surface, and sensing means for registering the extent of movement of the movable member. The movable member could be a wheel whose rim will grip the surface, and may have a friction tyre at the rim or a spiked rim. If the wheel is deformable under load, then it will provide a larger gripping surface. The preferred arrangement however is for the movable member to be in the form of a caterpillar track passing round a driven wheel. It is also possible for the movable member to be a tape wound onto a wheel and able to be drawn out from the printer housing as the wheel rotates, whilst the free end of the tape is held static. In all these arrangements ideally the sensing means registers the extent of rotation of the wheel. Thus the wheel could incorporate a circumferentially disposed array of equally spaced slots, with light transmitting and receiving means

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positioned either side of the wheel in alignment with the circumferential array of slots, to sense the passage of the sequence of slots.

In an alternative form the position transducer 5 comprises an optical sensor for registering an encoded grid pattern on a preprinted surface as viewed through the base portion, though this requires the printer to be used with specially preprinted paper. As another possibility the position transducer may be an absolute 10 encoding device which will register the positional state of the printer. A further example of a position transducer comprises an electromagnetic detection device for use with paper incorporating a coded magnetic pattern.

15 The printing unit could be of the impact type, but is most preferably in the form of an ink jet printing unit, including, for example, thermal, electrostatic and direct discharge ink jet types of unit. A thermal printing unit, other than of the ink jet type, is 20 another possibility. The command unit can incorporate a fixed command instruction or may be programmable to instruct a predetermined variable sequence of characters. This could be associated with a keypad for keying in the characters, either integrated with the printer or 25 connected to a separate unit.

The printer housing may take any convenient shape,

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but two preferred constructions are for the printer housing to have a handle projecting upwardly away from the base position (rather in the manner of an enlarged pen), or for the printer body to have the shape of a compact block for movement across a surface to be printed (in the nature of a so-called "mouse").

The invention may be performed in various ways and preferred embodiments thereof will now be described with reference to the accompanying drawings in which:-

10       Figure 1 is a side view of one form of hand-held printer of this invention;

Figure 2 is a rear view of the printer with a part thereof cut away;

15       Figure 3 is a vertical section through the printer of Figures 1 and 2;

Figure 4 is an underneath plan view of the printer of Figures 1 to 3;

Figure 5 is a plan view of an alternative form of hand-held printer of this invention; and

20       Figure 6 is a vertical section through the printer illustrated in Figure 5.

The printer illustrated in Figures 1 to 4 has a main housing 1 from which projects an upwardly extending handle 2. Within the housing portions 1 and 2 there are mounted an ink jet printer 3 and parts for controlling operation of the printer. Printed circuit boards

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4 and 5 are fed with signals through a cable 6 and carry electronic components for effecting necessary processing signals and creating drive control signals for the printer 3. In this arrangement a separate keyboard unit 5 (not shown) is provided to enable the user to prepare the sequence of characters which are to be printed by the printing unit 3 and this information is fed through the cable 6. The printer could be powered from the host unit through the cable 6. Alternatively the printer 10 could have an inbuilt battery power pack. A cradle module for connection to a mains power supply could be provided for mounting on electrical contacts on the printer for recharging the batteries. With such a 15 battery powered version data could be sent to the printer via an infra-red, laser or other optical link, or by induction techniques, or radio or ultrasonic signalling thus removing the need for an electrical link between the printer and the host unit.

When the printer is ready for use it is placed on to 20 a sheet on which the printing is to occur so that an opening 7 in the base of the housing 1 is in the desired position. This opening 7 is immediately below the printing jet for the ink jet printer 3. The printer, grasped by the handle 2, is then moved sideways across 25 the sheet and, in the process, causes a toothed belt 8 to be driven across the sheet. This belt then drives

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two wheels 9 and a main wheel 10 to cause rotation of a disc 11. The disc 11 incorporates an array of slots 12 and the passage of light from a lamp 13 is sensed by a collector 14 which sends signals to the processor carried by the board 4. These signals are indicative of the extent of movement of the printer over the sheet and enable the processor to determine the instants at which the ink jet printer unit 3 should be triggered to produce a particular character.

10 In the alternative form of printer illustrated in Figures 5 and 6 the housing is shaped as a compact block 15 which can be gripped from above and moved across the sheet where printing is to occur. This unit is more in the form of a so-called "mouse". Within this housing 15 are provided an ink jet printer unit 3, printed circuit boards 4 and 5 and a battery 16. The unit for sensing the position of the printer on a sheet comprises a wheel 17 (which is driven over the sheet surface as the printer is moved) which drives, through gearing, a disc 20 18 associated with an optical unit 19 for sensing the passage of slots in the disc. There is also a display device 20 which indicates the sequence of characters stored and which is to be printed. A print button 21 is provided on the side of the housing and on the top 25 there is a lamp 22 to indicate that the printer is in the ready state and a reset button 23. Transparent

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alignment guides 24 at the two sides of the housing provide added stability and also indicate the line 25 along which printing is to occur. These guides could be removably attached so that they can be omitted if  
5 desired.

The ink jet printer unit 3 is provided as a means of providing the necessary printed output since it is virtually silent in operation, vibration free, and has a low power consumption. Also it can be used at  
10 distances of up to 5mm from the paper with very little deterioration in print quality. However, other forms of printer could be used. Dot-matrix or character-based impact printers have higher power consumptions with the result that a hand-held unit would not be able  
15 to accommodate the required battery power unit. Also, they are somewhat noisy and require the provision of a printing ribbon so that there could be difficulties in ensuring that the correct gap between the printing head and the paper is maintained. Thermal printers are also  
20 a possibility, but they do require the use of thermal paper or a thermal transfer ribbon and the need to maintain a suitable gap between the printing head and the paper.

The means for sensing movement of the printer over  
25 the paper in the form of the caterpillar track 8 is preferred. However, wheels may also be used (as shown

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in Figure 6) and to minimize slippage the wheel rim may have a friction tyre or a spiked rim. The grip may be improved further by arranging that the wheel is deformable under load so as to increase the area of the  
5 rim in contact with the paper. Another possible movement sensor is a coiled tape on a spring-loaded play-out spool. The free end of the tape would be held in position on the paper before the printing stroke was started, and as the printer sweeps across the page the  
10 tape would be pulled out from its spool to turn an encoder wheel whose movement would be sensed. An optical sensor could be located in the base of the printer to detect an encoding grid printed on the surface of the paper. The microcontroller in the  
15 printer would then count the transitions as lines passed beneath the detector to enable the controller to calculate the position of the print head on the grid. This would however require the printer to be used with purpose-designed stationery.

20 Where the message to be printed is of a fairly standard form (including the provision for sequential numbering), a fixed message could be embedded in the microcontroller. This could be carried, for example, on a pre-prepared card. Time and date stamping (such  
25 as for the printing of sell-by dates) could be achieved by incorporating a real-time clock within the housing

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for the printer to enable the microcontroller to calculate the date or time to be provided.

Ideally the device will incorporate means for restricting printing to one direction only. This could  
5 be achieved electronically through the use of a quadrature detector. However this would not prevent the user from sliding the printer backwards between printing steps. A mechanical device is therefore preferred, and this could readily be achieved by a roller clutch in the  
10 mechanism for the "caterpillar" track comprising the belt 8 and wheels 9 and 10.

The printer is not limited to a single printable font. Characters of various sizes can be printed up to the maximum height allowed by the print head. Different  
15 styles of printing can be accommodated. For example, by staggering the printing of each row of dots an italic font may be generated. Similarly a bold font can be generated by thickening the vertical parts of each character by repeating the column printed.

20 It will be appreciated that printing can be applied, by the printer of this invention, to surfaces other than paper, such as plastics sheets, leather, or even carpet material.

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CLAIMS

1. A hand held printer having a generally flat base portion, a printing unit housed within the printer so as to be able to print through an aperture in the base portion, a command unit within the printer housing for instructing a sequence of characters to be printed by the printing unit, and a position transducer located within the printer housing for determining the extent of movement of the base portion across a surface with respect to a starting point and connected to the command unit to determine the instants of printing of characters as a function of said extent of movement.

2. A printer according to claim 1, wherein the printing unit is of the impact type or is in the form of an ink jet or thermal printing unit.

3. A printer according to claim 1 or claim 2, wherein the command unit incorporates a fixed command instruction or is programmable to instruct a predetermined variable sequence of characters.

4. A printer according to any one of claims 1 to 3, wherein the position transducer comprises a movable member projecting from the base portion to contact a surface to be printed and be moved with respect to the printer housing as the base portion is moved across the surface, and sensing means for registering the extent of

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movement of the movable member.

5. A printer according to claim 4, wherein the movable member is a wheel whose rim will grip the surface, the wheel preferably having a friction tyre at the rim or a spiked rim, and possibly being deformable under load.

6. A printer according to claim 4, wherein the movable member is a caterpillar track passing round a driven wheel or the movable member is a tape wound onto a wheel and able to be drawn out from the printer housing as the wheel rotates.

7. A printer according to claim 5 or claim 6, wherein the sensing means registers the extent of rotation of the wheel, the wheel possibly incorporating a circumferentially disposed array of equally spaced slots, with light transmitting and receiving means positioned either side of the wheel in alignment with the circumferential array of slots.

8. A printer according to any one of claims 1 to 3, wherein the position transducer comprises an optical sensor for registering an encoded grid pattern on a preprinted surface as viewed through the base portion.

9. A printer according to any one of claims 1 to 8, wherein the position transducer is an absolute encoding device which will register the positional state of the printer or an electromagnetic detection device for use

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with paper incorporating a coded magnetic pattern.

10. A printer according to any one of claims 1 to 9, wherein the printer housing has a handle projecting upwardly away from the base position or the printer body is in the shape of a compact block for movement across a surface to be printed.

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FIG.1

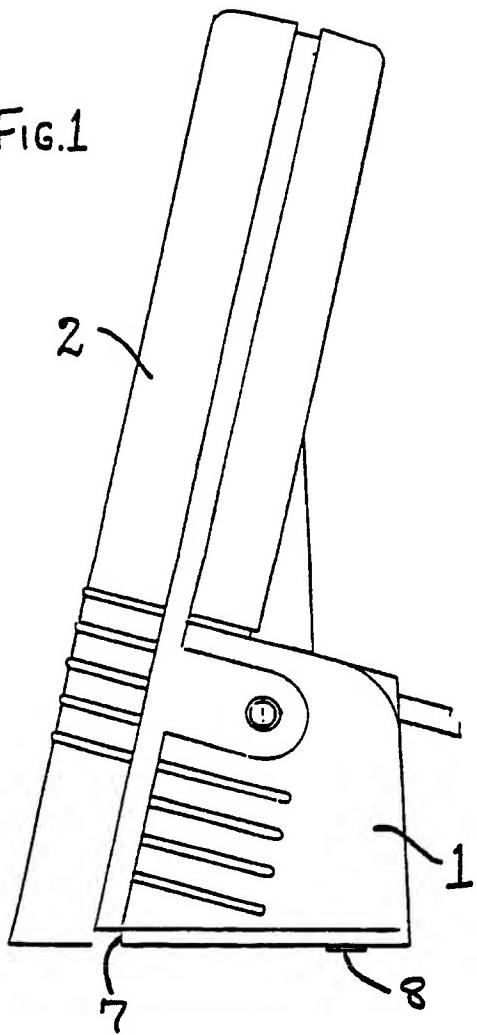


FIG.2

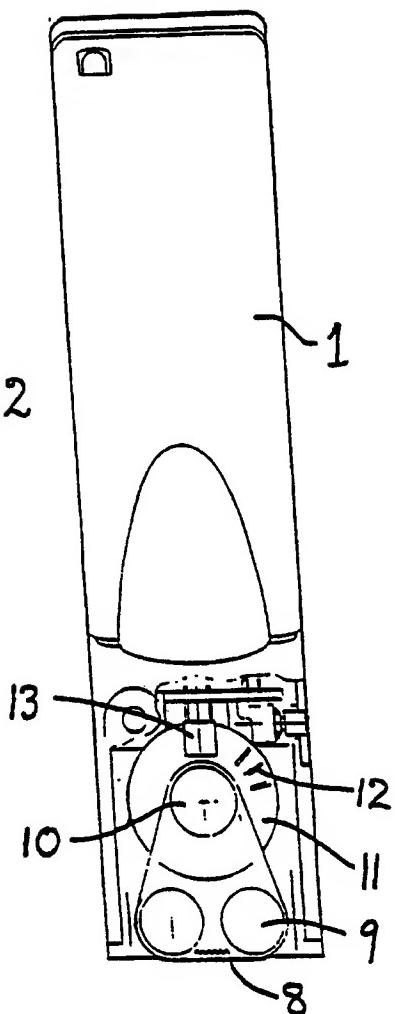
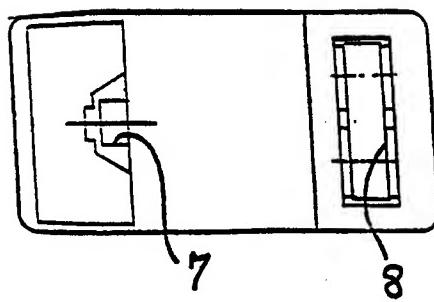
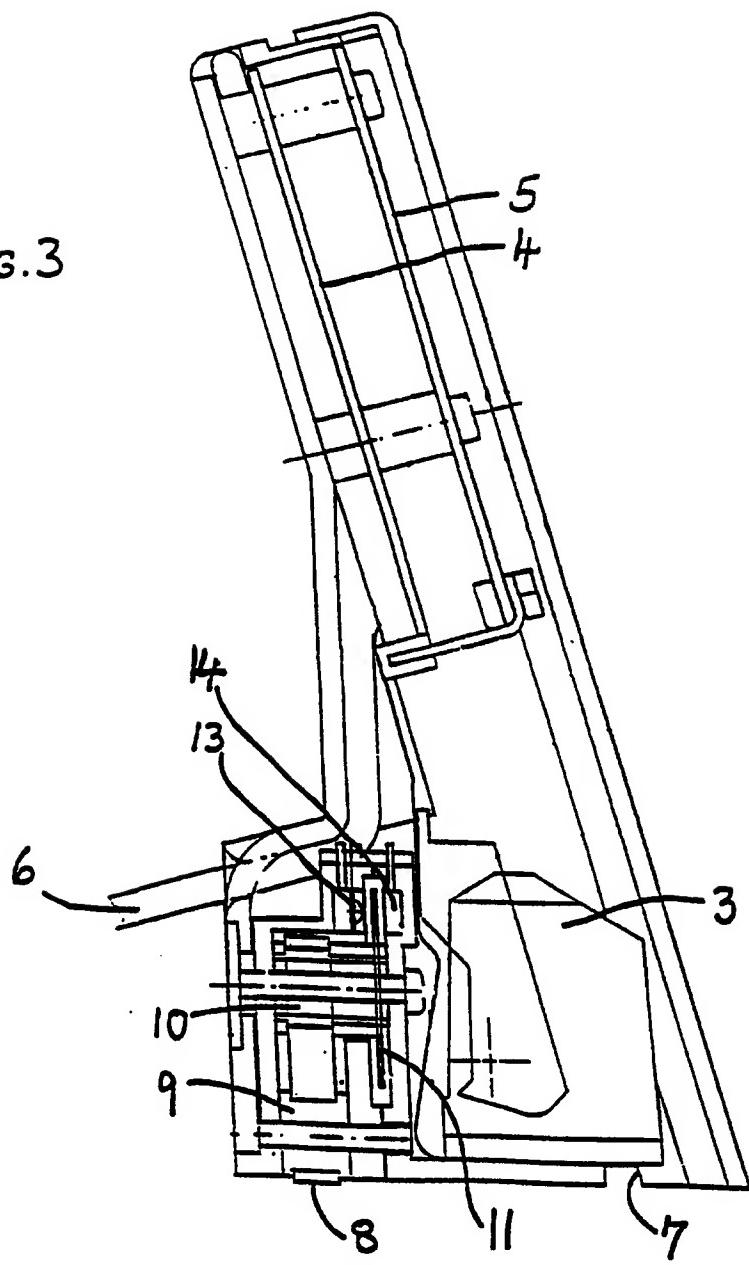


FIG.4



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FIG.3



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FIG. 5

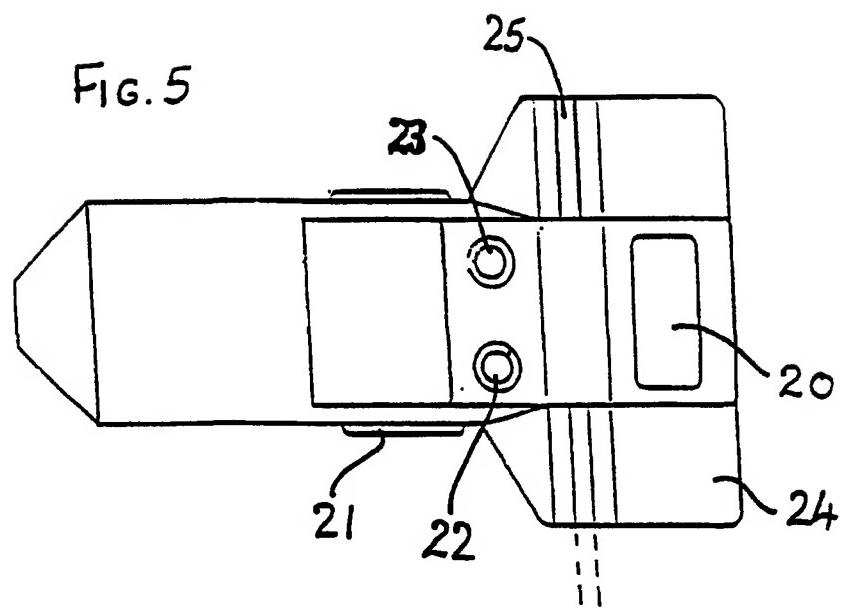
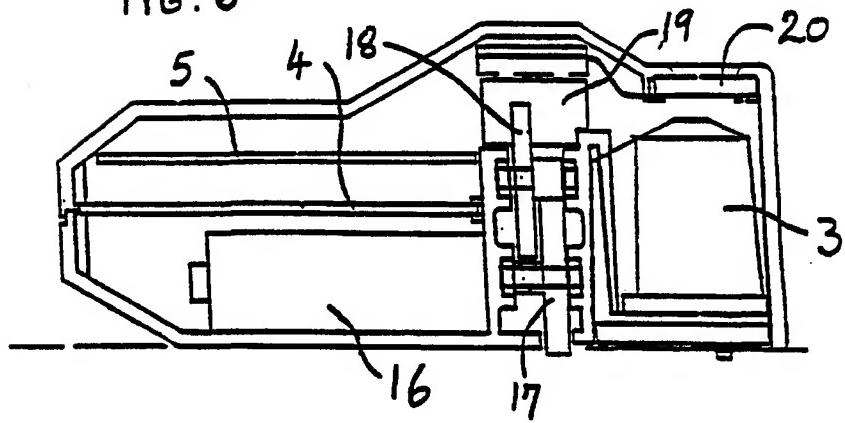


FIG. 6



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 90/00976

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)<sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B41J3/36

## II. FIELDS SEARCHED

Minimum Documentation Searched<sup>7</sup>

Classification System	Classification Symbols
Int.Cl. 5	B41J

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched<sup>8</sup>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup>

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	US,A,4523235 (RAJCHMAN, JAN) 11 June 1985 see abstract; figures see column 5, lines 14 - 48 see column 17, line 65 - column 18, line 35 see column 22, line 12 - column 23, line 59 ----	1-5, 7, 10
X	WO,A,8605142 (PERREN, BENNO) 12 September 1986 see abstract; figures see page 2, paragraph 3 - page 3, paragraph 2 see page 4, paragraph 2 - page 5, paragraph 3 ----	1-5, 8, 10
X	US,A,4168533 (SCHWARTZ, LEON J.) 18 September 1979 see abstract; figures see column 5, line 15 - column 7, line 2 see column 7, lines 33 - 61 see column 11, line 63 - column 12, line 48 ----	1-5, 7, 8, 10

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

12 OCTOBER 1990

Date of Mailing of this International Search Report

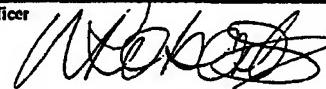
30 OCT. 1990

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	EP,A,285024 (CASIO COMPUTER COMPANY LIMITED) 05 October 1988 see abstract; figures 1, 2 see column 2, line 19 - column 3, line 12 see column 6, line 24 - column 7, line 54 see column 18, lines 27 - 37 ---	1-5, 7
X	PATENT ABSTRACTS OF JAPAN vol. 10, no. 109 (M-472)(2166) 23 April 1986, & JP-A-60 240469 (NOBUO OONUKI) 29 November 1985, see the whole document	1, 3, 10
A	---	9
A	DE,A,2300421 (STEINHILBER, HELMUT) 11 July 1974 see page 2, paragraph 2 - page 3, paragraph 3 see page 4, paragraph 2 see page 5, paragraph 3 ---	4-7

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9000976  
SA 38314

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4523235	11-06-85	US-A-	4510390	09-04-85
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US-A-4168533	18-09-79	AU-B- AU-A- CH-A- CH-A- CH-A- FR-A, B SE-B- SE-A- CA-A- CA-A- CA-A- DE-A, C DE-A- GB-A- GB-A- JP-A, B JP-A- JP-A-	516369 3468178 632607 642470 642471 2386869 437576 7803847 1102391 1104255 1097719 2701072 2760459 1566341 1566342 52116299 63000691 63000692	28-05-81 11-10-79 15-10-82 13-04-84 13-04-84 03-11-78 04-03-85 07-10-78 02-06-81 30-06-81 17-03-81 21-07-77 29-09-88 30-04-80 30-04-80 29-09-77 05-01-88 05-01-88
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DE-A-2300421	11-07-74	None		